NIKON EM

Batteries: 2 ea. 1.5V S-76 (negative ground)

Fig. 1 — top cover removed

Fig. 2 — bottom cover removed

Fig. 3 — lens-mounting ring removed

Fig. 4 — front view, mirror box removed

Fig. 5 — mirror box, wind side

Fig. 6 — top view, main flex removed

Fig. 7 — mirror-actuating unit of mirror box removed

Fig. 8 — bottom view of wind seat, timed position

Fig. 9 — flex connector, pictorial and test points

Fig. 10 — flex circuit, wiring

Fig. 11 — IC pin voltages

Fig. 12 — test setup for fast adjustments

ADJUSTMENT LOCATIONS:

Constant voltage, flash	A*
Speeds ratio	B
Speeds level	C
Flash speed and buzzer	D*
Meter readout, ratio	E
Meter readout, level	F
Release-button switch	G
Release overtravel	H
Travel time, second curtain	I
Travel time, first curtain	J
Trigger (timing) switch	K**
Memory switch	L

*requires Nikon Speedlight SB-E, special Nikon tool, or current source to adjust
** do not disturb

ADJUSTMENT VALUES:

Curtain-travel time:	6ms (20mm distance)
Flange-focal distance:	46.67+0.02mm (flange to pressure-plate rails)
	46.44+0.02mm (flange to film-guide rails)

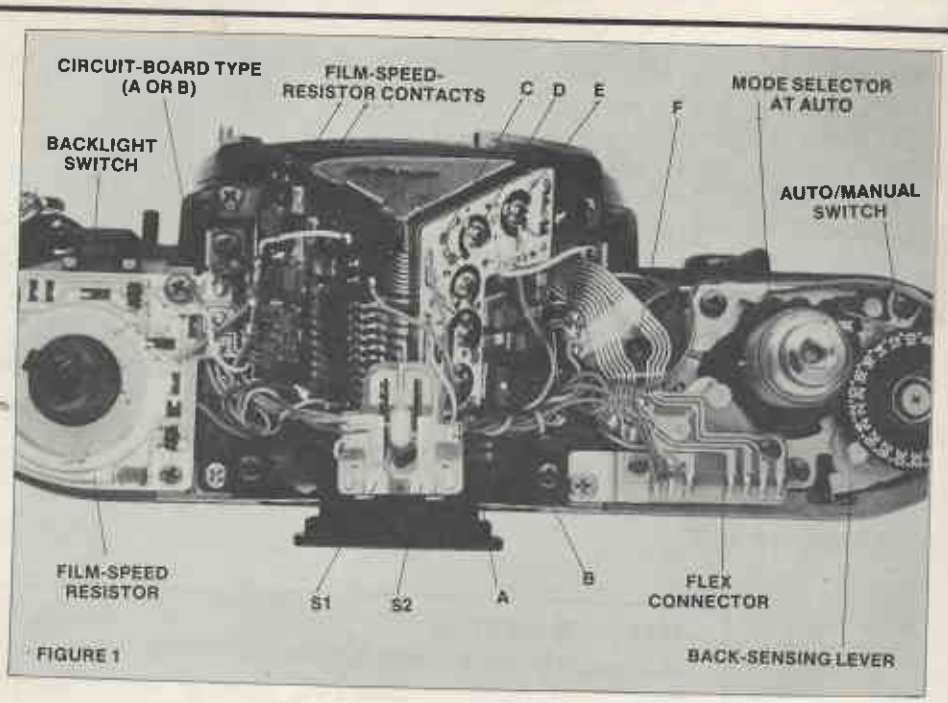

FIGURE 1

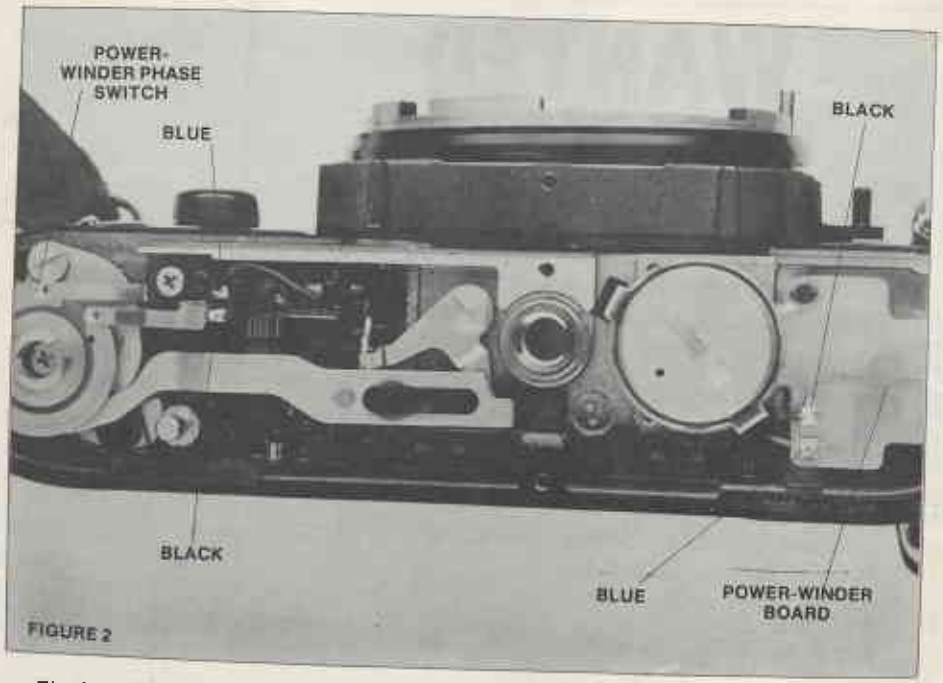

FIGURE 2

Flash speed and mechanical speed: 1/90
Initial tension, spring for aperture-coupling ring: 4 turns
X-sync delay: 0.3 - 1.0ms

Release overtravel: The mirror should release when you depress the release button 1.7mm; the release button should have a slight overtravel after the mirror releases. You can reach the eccentric — H in Fig. 4 — through a clearance hole in the front plate.

Memory switch: The memory switch should close slightly before the mirror starts to rise. To check, charge the mirror box and connect an ohmmeter between the two memory-switch contacts, Fig. 5. Hold the diaphragm-closing lever from the front of the mirror box. Then release the mirror box and allow the

diaphragm-closing lever to move down slowly. When the memory switch closes, there should still be a 1 - 1.4mm space gap between the mirror-lifting lever and the mirror tab, Fig. 5. Adjust with eccentric L.

Shutter release: The shutter should release when the mirror is 1 - 3mm from the porous-plastic light trap at the top of the mirror box. To check, hold the diaphragm-closing lever and allow the mirror to move up slowly. The adjustment (not shown) is the eccentric accessible through a front-plate clearance hole below the self-timer lever.

Continuous release (for power-winder operation): The mirror should release during continuous operation when the transport latch moves half way into the slot in the transport cam, Fig. 6 (visible with the main flex removed). To check, put finger pressure on the sprocket and hold the release button depressed. Then rotate the motor-drive coupler from the bottom of the camera while watching the transport latch. Adjust by shifting the position of the wind seat.

Release-button switch: The release-button switch should close, giving direct continuity between the two blades which connect to the shutter flex, Fig. 4, when the release button moves down 0.6 ± 0.1mm. With the camera assembled, check to see how far you have to depress the release button to turn on the meter. Reach the eccentric — G in Fig. 4 — through a front-plate clearance hole.

Overexposure/slow-speed warning: The piezo buzzer in the top cover should beep if the indicated shutter speed is faster than 1/1000 (needle just above "1000") or slower than 1/25 (needle half way between "30" and "15"). The adjustment — D in Fig. 1 — also affects the flash speed on auto.

Trigger switch: The eccentric provides a fast-speed (high-light-level) adjustment. Avoid disturbing the eccentric; there is no clearance hole in the front plate to provide access with the camera assembled.

Sprocket timing: The center of a sprocket tooth should be 27.6 ± 0.5mm from the lead edge of the aperture.

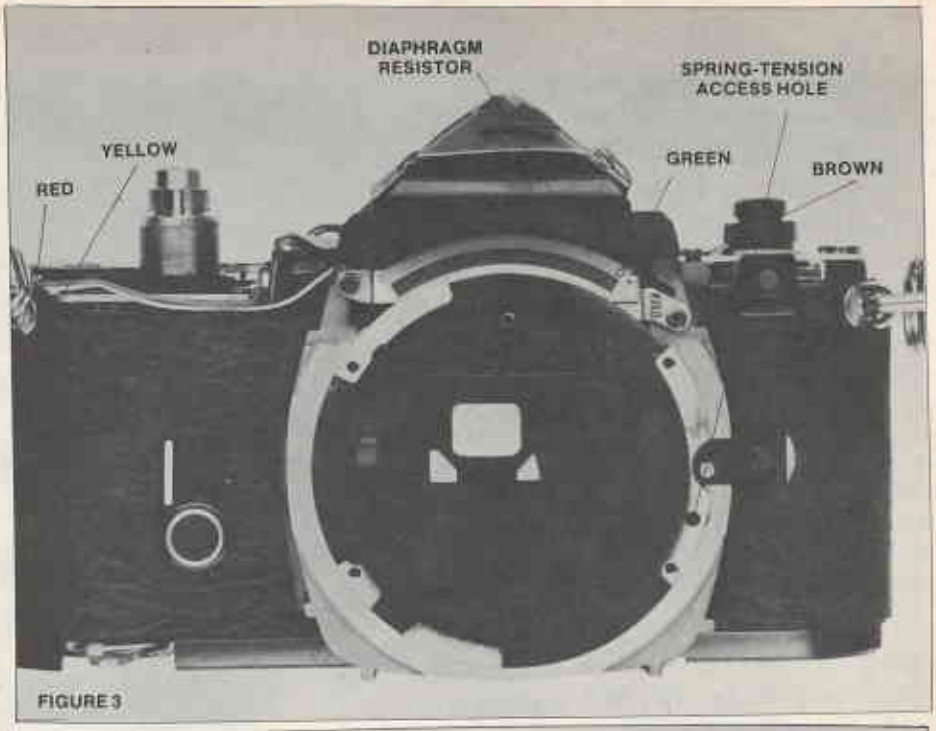

FIGURE 3

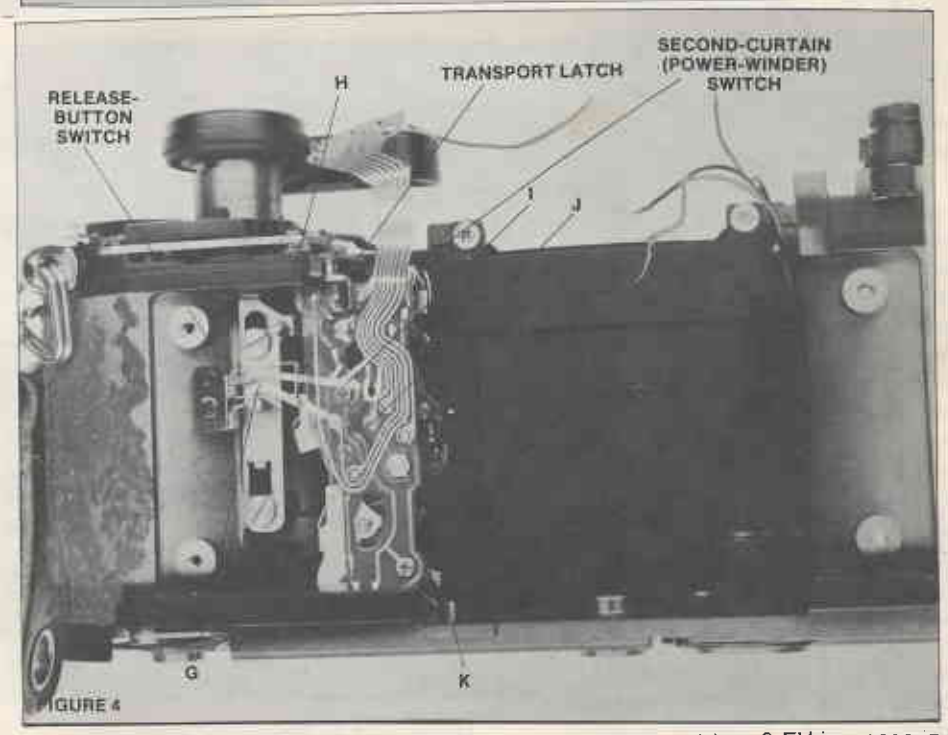

FIGURE 4

ADDITIONAL OPERATION TESTS:

Note: The counter dial must reach the "1" calibration and the mode selector must be at auto before the camera will work electronically. When the counter dial reaches "1," it closes the auto-manual (blank-shot) switch, Fig. 1, if the mode selector is at auto. To operate the camera with the back open, wedge in the back-sensing lever, Fig. 1, and advance the wind lever until the counter reaches "1."

1. The meter readout should remain on for 30 seconds after you let up the release button.
2. Pushing in the backlight button should provide a 2 EV increase in exposure.
3. Pushing in the battery-test button should light the top-cover LED if more than 2.25V is supplied to the battery box. The battery-test LED should not turn on with less than 2V supplied.
4. With the Nikon SB-E Speedlight installed, the auto speed should change to 1/90 and the red LED in the finder should glow. You can check the LED by injecting 0.5ma into the S1 terminal of the hot-shoe connector, Fig. 1 and Fig. 12. The voltage at pin 14 of the IC should go to 1.5V, and the LED

should glow. Changing the diaphragm setting and the film-speed setting affects the flash output.

ADJUSTMENT SEQUENCE:

1. Speeds ratio (resistor #1). Set EV 9, ASA 100. Check the exposure time on auto at the f/16 and f/2 settings. The exposure time at f/16 should be 64 times as slow as the exposure time at f/2. To increase the difference, turn the wiper clockwise.
2. Speeds level (resistor #2). Set EV 9, ASA 100, f/4. Adjust for a 0 EV error or for a shutter speed of 27 - 35ms.

Note: Alternately, you can use the ratio adjustment (B) for high light levels and the level adjustment for low light levels. Work back and forth between the two adjustments.

3. Flash speed (resistor #4). Adjust for an exposure time of 10.3 - 11.5ms with the flash unit installed. Alternately, inject 30μa (+5, -0) into the S1 hot-shoe contact, Fig. 1 and Fig. 12, to simulate the flash signal.
4. Meter readout (resistor #5). Set EV 9, f/4, ASA 100. Adjust for a meter reading of 1/30. Then check the meter readout at other light levels. If necessary, use the hair-spring adjustment (F) as a low-light adjustment and use the variable resistor as a high-light adjustment.
5. Flash voltage (resistor #3). Inject 20μa (+0.25, -0) into the S2 terminal of the hot-shoe connector, Fig. 1 and Fig. 12. Set ASA 100 and f/4. With the release button partially depressed, adjust A for a 1353mv reading at the S2 terminal. Changing the f/stop or the film speed should change the voltage reading.
6. Check the operation of the piezo buzzer. If the buzzer does not turn on at the proper times, adjust variable resistor D (#4). Then re-check the flash speed (step #3).

DISASSEMBLY HIGHLIGHTS:

Locations of left-hand threads; retainer holding wind lever; lower wind-shaft bushing

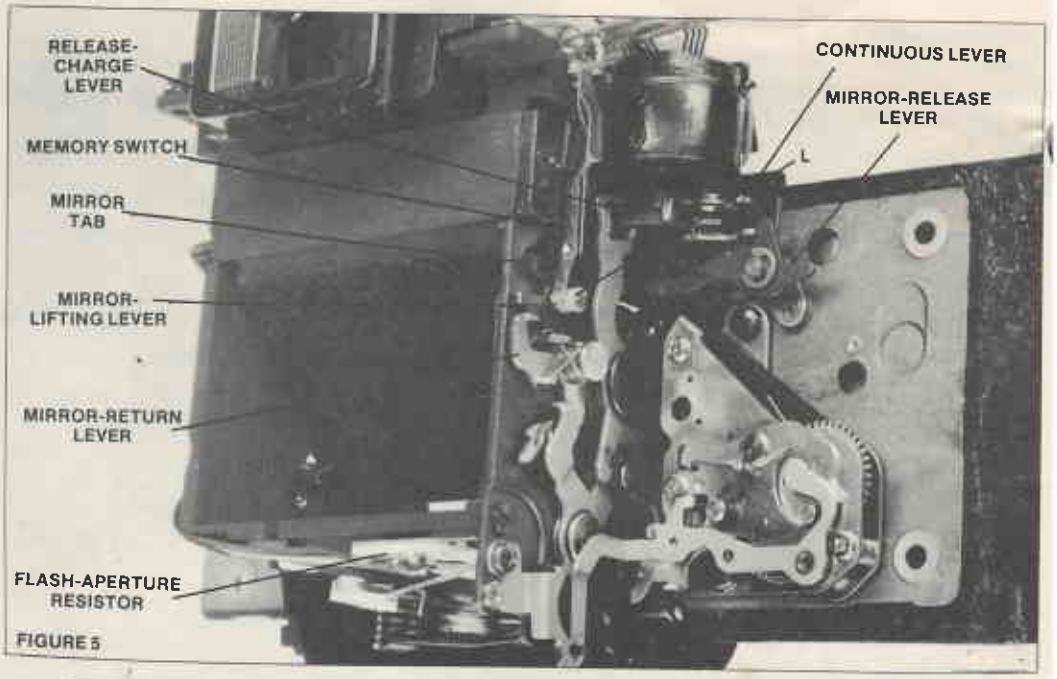

FIGURE 5

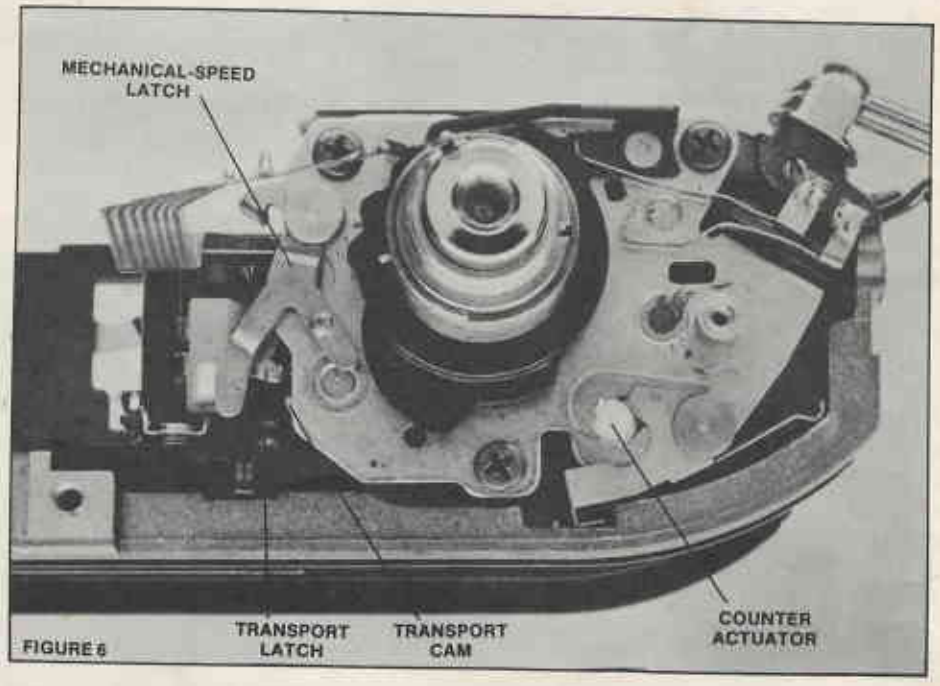

FIGURE 6

Control positions: unimportant

Precautions:
1. Avoid using strong solvents on plastic parts.
2. Avoid overtightening screws which go into plastic parts.
3. Avoid overtightening screws holding the film-speed board. Overtightening the screws will crack the ceramic board.
4. Remove the batteries before unsoldering wires from the main flex.
5. Use a grounded soldering iron.

Sequence:
1. bottom cover, back cover, top cover
2. pull loose piezo buzzer from top cover (or unsolder piezo wires from circuit board)
3. unsolder from top:
   - blue wire and green wire from flex connector

- red battery wire (connects to 2 lands)
- black wire that comes from power-winder board (connects to 2 lands)
- red wire and yellow wire from auto-manual switch, Fig. 3, or from flex

4. 2 screws holding flex connector, Fig. 1
5. unsolder flex-connector lands to separate 2 sections of flex (main flex from shutter flex)
6. 3 screws holding film-speed board
7. lift film-speed board from rewind-shaft housing (backlight switch loose)
8. 2 upper mirror-box screws, top of camera toward back (1 screw also holds support plate for flex connector)
9. remove rewind-side leatherette
10. peel back wind-side leatherette to uncover 2 screws
11. 4 front-plate screws
12. front-plate/mirror-box assembly

Reassembly highlights:
Cock the shutter and the mirror box before replacing the front-plate/mirror-box assembly.

Sequence to remove shutter:

1. install wind lever to hold tension on wind-lever spring
2. wind seat (3 screws)
3. unsolder connectors from release-button switch at shutter flex, Fig. 4
4. release-button switch (1 screw)
5. unsolder black wire and blue wire from power-winder phase switch, Fig. 2
6. peel loose tape holding battery and power-winder wires, rewind side
7. shutter-retaining screws (1 at back of aperture, 2 at top of shutter)
8. shutter (depress release slide and tilt shutter forward until it clears the body casting — then lift out shutter)

Reassembly highlights:

1. Depress the release slide as you seat the shutter. Also push the Delrin bulb lever from left to right so that the lug on the release slide fits under the bulb-lever pin.
2. The wind seat must be timed to the wind shaft. Before replacing the wind seat:

a. Position the power-winder phase switch so that its hole is on a line running parallel to the front and back of the body casting (the hole points to the center of the body.) body).

b. Rotate the sprocket until its clearance hole points to the back of the camera; turn the sprocket shaft until the screw is visible through the clearance hole. Push down the sprocket shaft so that the screw engages the groove inside the sprocket. Then rotate the sprocket to the timed position (center of tooth 27.6mm from lead edge of aperture).

c. Set the mode selector to the bulb position.

d. Position the counter actuator, Fig. 6, so that its cutout points toward the release button.

e. Make sure the end of the pawl spring is in the pawl notch, Fig. 8.

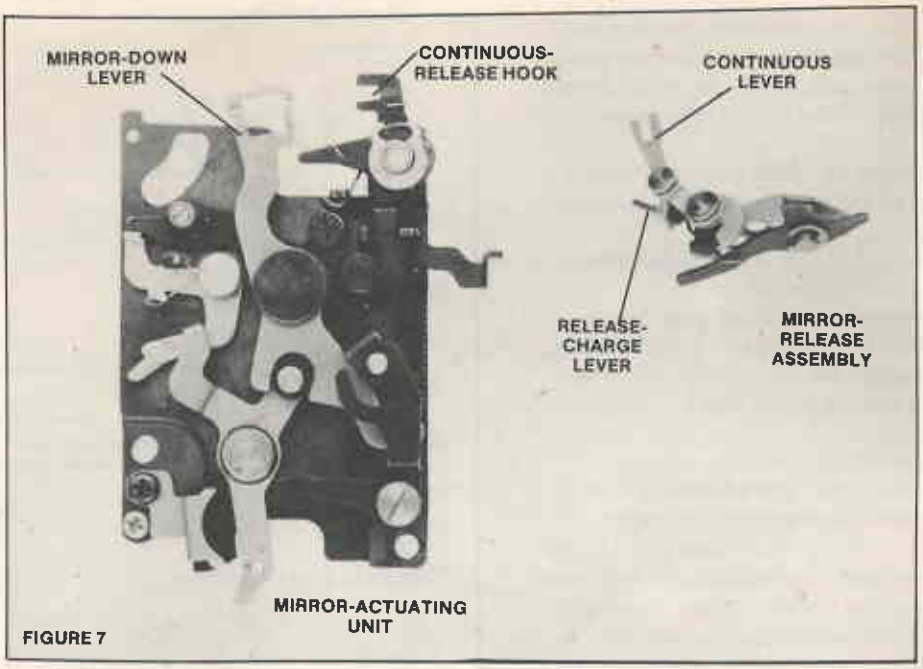

FIGURE 7

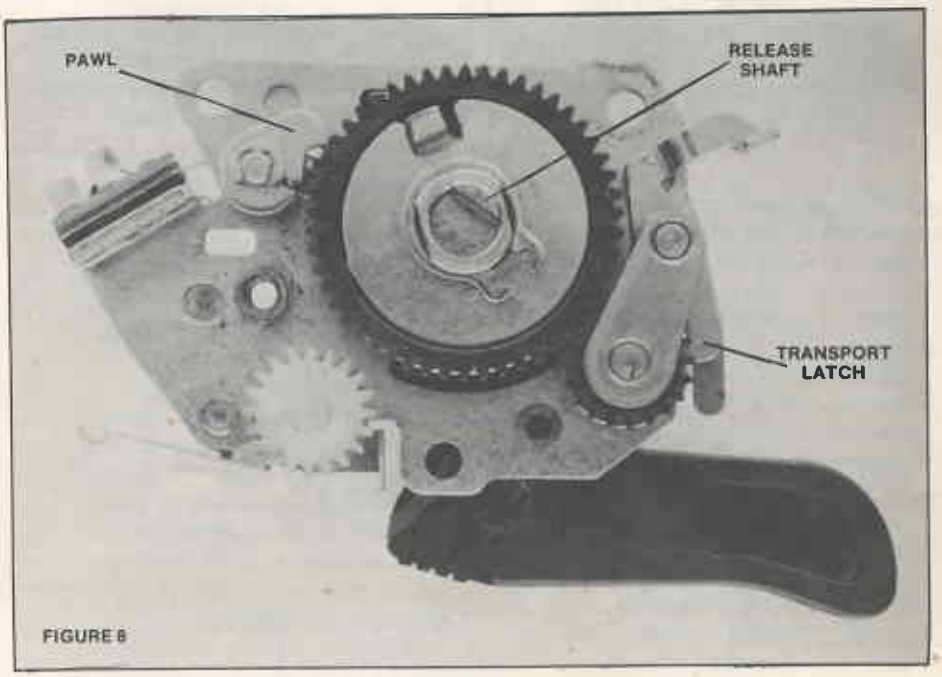

FIGURE 8

To install the wind seat:

a. Advance the wind lever until the transport latch passes into the slot in the transport cam, Fig. 8. Allow the wind lever to return until it's perpendicular to the camera body; hold the wind lever in position, against the pressure of the return spring.

b. Position the cutout in the release shaft, Fig. 8, over the body casting next to the release slide. The release-shaft tab then sits on top of the release slide after reassembly.

c. Seat the wind seat, making sure that the brass mechanical-speed lever passes to the wind-lever side of the Delrin bulb lever.

Sequence to reach diaphragm resistor (not necessary to remove mirror box):
1. lens-mounting ring (4 screws)
2. bayonet spring
3. aperture-coupling ring
4. front-cover plate (lens-release button loose)
5. aperture-brush ring

Reassembly highlights:
1. Seat the aperture-brush ring; turn the ring fully clockwise.
2. Lift the aperture-brush ring high enough to disengage it from the nylon pinion. Then, working through the access hole, Fig. 3, apply 4 turns of initial tension (counterclockwise) to the aperture-coupling spring (the spring is on the rewind side of the mirror box). Hold the spring tension as you reseat the aperture-brush ring.

Sequence to remove main flex (not necessary to remove mirror box):
1. unsolder wires from main flex and from film-speed board (the wires that come from the camera body)
2. unsolder flex-connector terminals and remove 2 flex-connector screws
3. unsolder connections to flash LED, Fig. 10
4. unsolder connections to memory switch, Fig. 10
5. prism springs
6. film-speed board (3 screws)
7. contact holding photodiode (reach screw through slot in hot-shoe contact, Fig. 1)
8. free section of main flex that mounts photodiode
9. main flex and film-speed board
10. pentaprism

Sequence to remove mirror-actuating unit from side of mirror box:
1. self-timer lever
2. self-timer mechanism (2 screws)
3. memory switch (1 screw)
4. mirror-release assembly, Fig. 5 (2 screws)
5. 3 screws holding mirror-actuating unit (1 screw in lower left-hand corner, Fig. 5, and 2 screws accessible through cut-outs in front-plate casting)
6. hold mirror-tensioning spring at bottom of mirror box and lift out mirror-actuating unit

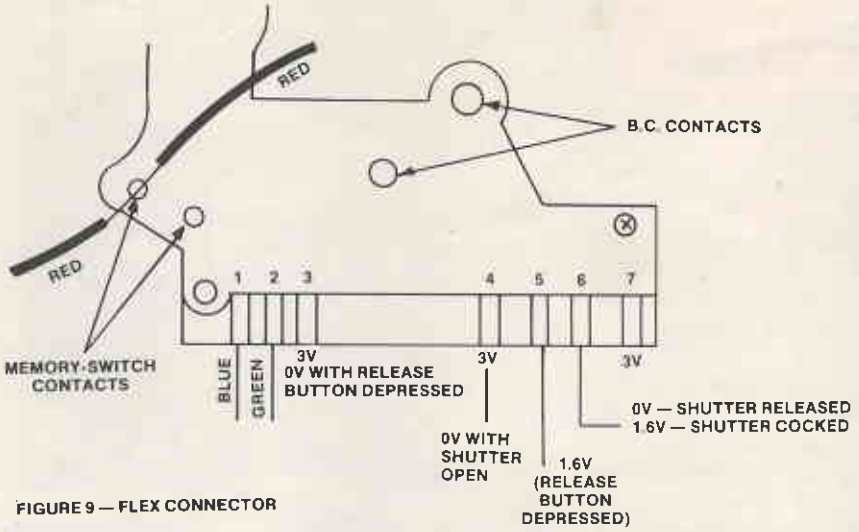

FIGURE 9 — FLEX CONNECTOR

Terminal 1 — second-curtain switch
Terminal 2 — X-sync contact
Terminal 3 — Release-button switch
Terminal 4 — Electromagnet
Terminal 5 — Trigger switch
Terminal 6 — Trigger switch
Terminal 7 — Electromagnet

Reassembly highlights:
1. Connect the mirror-tensioning spring to the hole in the mirror-tensioning lever as you seat the mirror-actuating unit.
2. To replace the mirror-release assembly, pass the end of the release-charge lever, Fig. 7, into the hole of the mirror-down lever. Also seat the forked end of the continuous lever over the forked end of the continuous-release hook, Fig. 7.

TROUBLESHOOTING:
Behavior without batteries: shutter delivers fastest speed only at auto, needle stays at top of scale

Typical current draw (3V supplied):
meter — 1.5 - 2ma
shutter open — 10 - 12ma
piezo buzzer — 2.6ma
battery test — 28ma

Positions and functions of switches:
1. Auto-manual switch: Controlled by mode selector and by counter dial, Fig. 1. Closes at the auto setting when the counter dial has reached the "1" position to connect the control circuit to positive battery. Opens at M90 (mechanical 1/90) and bulb; also opens when the counter dial returns to the start position.
2. Backlight switch: Front of camera, under film-speed board, Fig. 1. Pushing in the backlight button shorts across a resistor on the film-speed board to provide an intentional overexposure.
3. Battery-test switch: In top cover. Pushing the battery-test button engages the two B.C. contacts on the main flex, Fig. 9, to turn on the top-cover LED.
4. Release-button switch: Front of body casting, controlled by the release slide, Fig. 4. Closes when you push the release button half way to turn on the meter readout and the buzzer warning.
5. Memory switch: Side of mirror box, Fig. 5. Closes just before the mirror starts to rise to provide power to the electromagnet and to memorize the exposure.
6. Trigger (timing) switch: In shutter, Fig. 4. Opens as the first curtain starts to move, beginning the timing cycle.
7. Second-curtain switch: In shutter, Fig. 4. Closes with the shutter in the released position, providing direct contact between the black wire and the blue wire at the power-winder board, Fig. 2.
8. Power-winder phase switch: At the bottom of the camera, Fig. 2. Maintains direct continuity

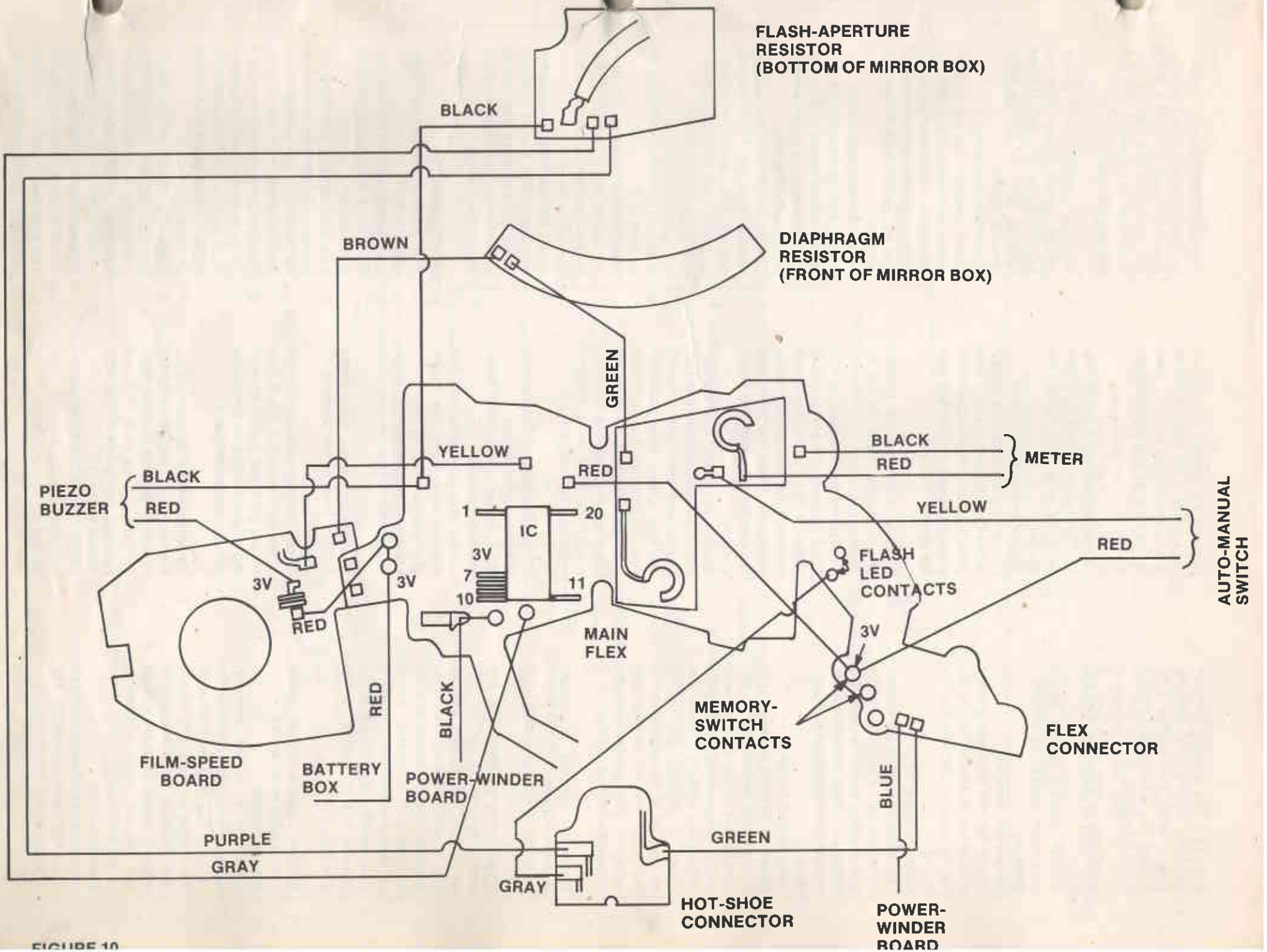
FLASH-APERTURE
RESISTOR
(BOTTOM OF MIRROR BOX)
BLACK
BROWN
DIAPHRAGM
RESISTOR
(FRONT OF MIRROR BOX)
GREEN
YELLOW
RED
BLACK
RED
METER
PIEZO
BUZZER
BLACK
RED
1
20
IC
3V
7
10
11
3V
3V
RED
YELLOW
RED
AUTO-MANUAL
SWITCH
FLASH
LED
CONTACTS
3V
MAIN
FLEX
MEMORY-
SWITCH
CONTACTS
FLEX
CONNECTOR
RED
BLACK
BLUE
FILM-SPEED
BOARD
BATTERY
BOX
POWER-WINDER
BOARD
PURPLE
GRAY
GREEN
GRAY
HOT-SHOE
CONNECTOR
POWER-
WINDER
BOARD

FIGURE 10

between the power-winder terminals during the cocking stroke. With the shutter fully cocked, the rear contact should be off the contact path.

Troubleshooting steps for specific problems:

1. Shutter delivers fastest speed only, meter stays at top of scale
   Batteries
   Battery box or wires
   Check for +3V between ground and the red wire at the flex, Fig. 10.
   No voltage — battery box or wiring.
   Battery voltage to IC
   You should measure the battery voltage at pin 7, Fig. 11, even if the auto-manual switch is open. No voltage — check red-wire solder connections and ground connections.
   Auto-manual switch
   Check for 3V at the red wire to the auto-manual switch, Fig. 1. No voltage — check the red-wire solder connections. At the auto setting and with the counter dial at the "1" position, you should also get 3V at the yellow wire of the auto-manual switch. No voltage — poor contact or auto-manual switch not closing.

2. No meter readout or buzzer, shutter operates
   Release-button switch, not closing
   Check with an ohmmeter between terminal 3 of the flex connector, Fig. 9, and ground; you should get direct continuity with the release button pushed half way. Alternately, short between terminal 3 and ground. If your short turns on the meter, the release-button switch is the problem.

3. Shutter delivers fastest speed only at auto, meter works
   Memory switch
   Check for 3V at the memory-switch connection that has the red wire, Fig. 10. Then hold open the shutter on bulb. You should now measure 3V at the second memory-switch land. No voltage with shutter open — memory switch not closing.
   Electromagnet
   Check the coil between terminals 4 and 7 of the flex connector, Fig. 9. Approximate coil resistance — 320 ohms. Alternately, short terminal 4 to ground and release the shutter. If the electromagnet is o.k., the shutter will stay open for as long as you maintain the short.
   IC
   Check the voltage at pin 19, Fig. 11. The voltage should drop from 3V to 0V when you release the shutter.
   Trigger switch, poor contact
   Check between terminals 5 and 6 of the flex connector, Fig. 9. You should get direct contact with the shutter cocked, no contact with the shutter released.

4. Shutter delivers only fastest speed, needle stays at top of scale, piezo beeps
   Film-speed resistor, poor contact
   Short between the two contacts shown in Fig. 1 of the film-speed resistor. If the needle then moves downscale, clean the film-speed resistor and improve the brush contact.
   Diaphragm resistor, poor contact
   Check the resistance between the brown wire (film-speed board) and the green wire (variable-resistor board). Approximate resistance range as the aperture-coupling ring rotates counter-clockwise (one wire disconnected): 7.5K - 390 ohms.

5. Shutter hangs open, needle pegs to bottom, piezo beeps
   Poor solder, wires from flash-aperture resistor
   Check the gray wire and the orange wire from the flash-aperture resistor, Fig. 10
   Flash-aperture resistor, poor contact

6. Shutter hangs open, meter works
   Trigger switch, not opening or shorted
   Check between terminals 5 and 6 of the flex connector, Fig. 9. You should get direct continuity with the shutter cocked, no continuity with the shutter released.

7. Camera always draws current
   Memory switch, constantly closed or shorted (current draw around 1.6ma with shutter released and over 10ma with shutter cocked)
   Check between the two memory-switch contacts, Fig. 10. You should get no continuity until the mirror starts to rise.
   Release-button switch, constantly closed (current draw normal)
   Check between terminal 3 of the flex connector and ground. You should get no continuity until you depress the release button.

8. Improper operation with power winder (power winder does not advance, skips, continues running, jams, or causes overlapping frames)
   Second-curtain switch
   Check between the two power-winder terminals, Fig. 2, with an ohmmeter. You should get direct contact with the shutter released and no contact with the shutter cocked.
   Power-winder phase switch
   Clean the conductor of the power-winder phase switch, Fig. 2, and improve the brush contact.
   Mirror-actuating unit
   Check for a bent or broken release hook, Fig. 7. If damaged, replace the complete mirror-actuating unit #FA2.301 (individual parts not available).

9. Improper operation with dedicated flash unit
   Poor contact between hot-shoe connector, Fig. 1, and hot shoe
   Flash-aperture resistor, poor contact or wires
   Check by meauring the voltage to terminal S2, Fig. 1, while injecting 20µa into S2, Fig. 12. The voltage should change as you change the diaphragm setting.

OTHER COMMENTS:

1. The product number for parts orders is 23FB.
2. Early versions of the EM (the first 2000) have three wires going to piezo buzzer.
3. You can remove the focusing screen from inside the mirror box for cleaning. Take out the screw at the top front of the mirror box.
4. The Seiko shutter is only supplied as a complete unit. However, most parts will interchange with those in other Seiko focal-plane shutters.
5. Except for the IC (#104), circuit components are not available individually. A replacement main flex (FPC — A18) comes complete with all components including the silicon photodiode. The film-speed board is separate.
6. The film-speed board comes in two types. Identify the type by the

"A" or "B" in the corner, Fig. 1 (ASA base plate — A14A or A14B). Also match a replacement diaphragm resistor (f-fo base plate — B13A or B13B) to the type of film-speed board.

7. The brushes for the power-winder phase switch (MD contact — A15) have been revised to improve contact. The new-style brushes have multiple contacts.
8. The battery box part number is "battery chamber — 23FB A11."
9. If the aperture-coupling ring does not return under spring tension, the spring may be slipping on the nylon shaft (rewind side of mirror box). Apply super glue to the end of the spring to prevent slipping. It's not necessary to remove the mirror box; you can reach the spring from the front after taking out the aperture-brush ring.
10. In the most recent cameras, a set-screw locks the retainer for the wind lever. If the wind-lever retainer works loose, clean its threads and apply some cement.
11. The self-timer-lever screw has a locking agent on the threads. You can soften the locking agent by heating the screw.

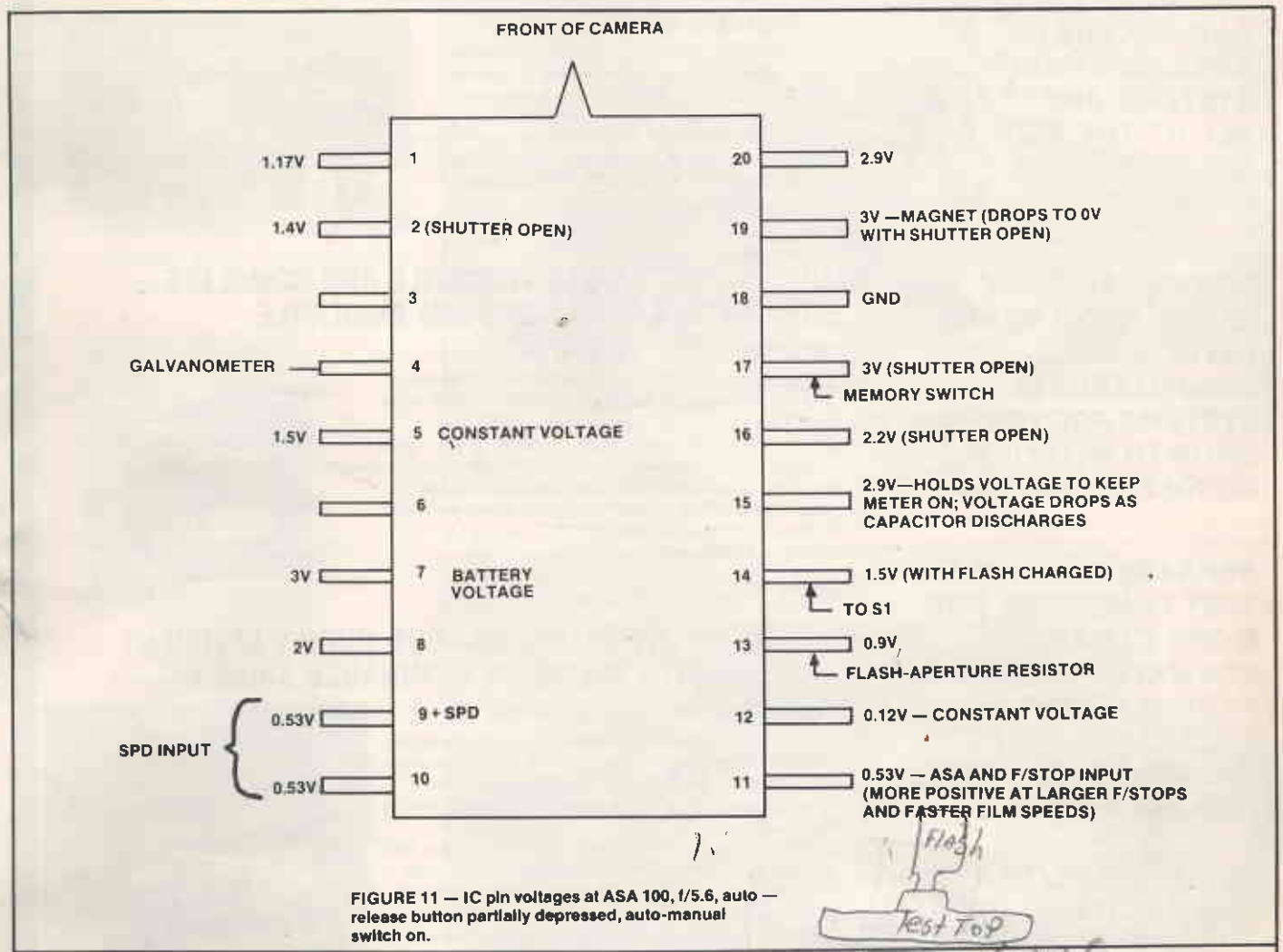

FIGURE 11 — IC pin voltages at ASA 100, f/5.6, auto — release button partially depressed, auto-manual switch on.

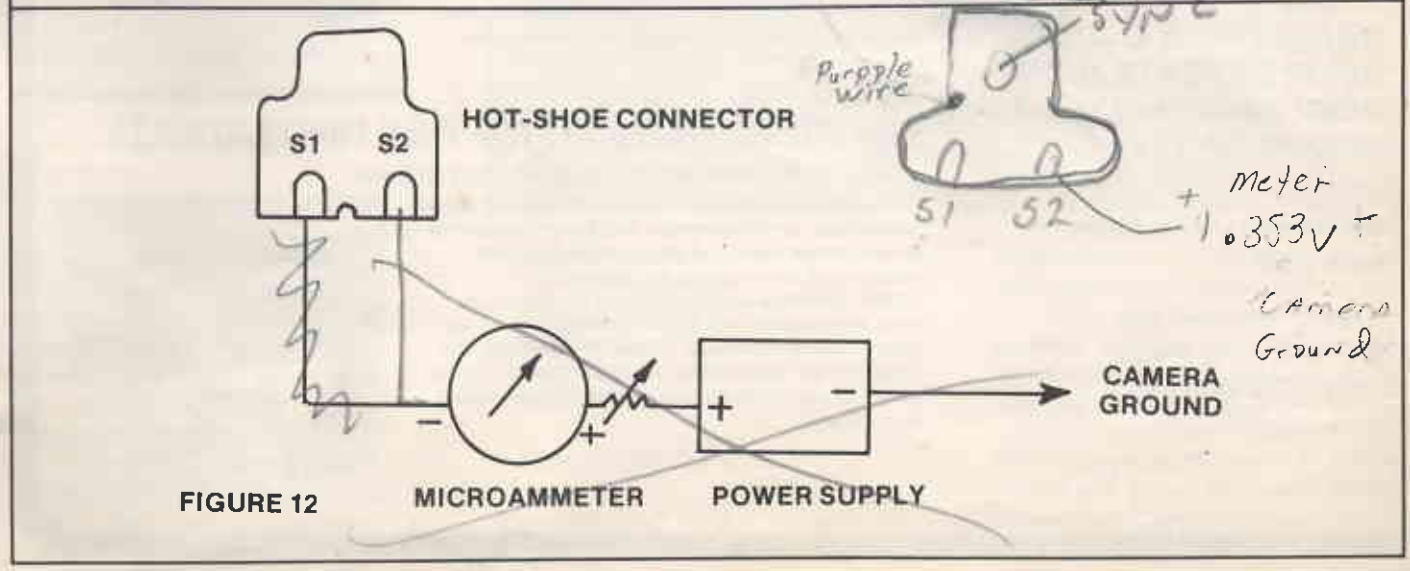

FIGURE 12